

CLAIMS

What is claimed is:

1. A method of decomposing an image comprising the steps of:
- a) decomposing the image into a plurality of stripes;
 - b) decomposing each stripe into foreground and background image layers, and a mask layer; and
 - c) interpolating irrelevant pixel values in the foreground and background layers for coder efficiency.
2. The method of claim 1 further comprising the step of:
- d) encoding the foreground, background, and mask layers.
3. The method of claim 2 wherein the foreground and background are JPEG encoded, wherein the mask is JBIG encoded.
4. The method of claim 1 wherein step c) further comprises the steps of:
- i) determining a layer base color and offsets to a common reduced area of each layer to identify image and mask layer values for all regions except an overlapped common reduced area; and
 - ii) separating the overlapped common reduced area into foreground and background layers.
5. The method of claim 1 wherein step c) further comprises the steps:
- i) classifying each pixel within a selected block of a selected layer as relevant or irrelevant;
 - ii) generating a coefficient block representing a forward transform of the selected block; and
 - iii) modifying coefficient values to generate a modified coefficient block subject to a set of pre-determined constraints including a

8 constraint that the relevant pixels have a same value in an inverse
9 transformation of the modified coefficient block as in the selected block.

1 6. The method of claim 5 wherein step c)iii) includes the steps of:

2 a) selecting a coefficient from the coefficient block in a reverse
3 zig-zag order wherein the selected coefficient has a non-zero value; and

4 b) finding a feasible solution resulting in a zero quantizable
5 selected coefficient subject to the pre-determined constraints.

1 7. The method of claim 5 wherein the coefficient values are modified
2 subject to a constraint that no zero quantizable coefficient preceding the
3 selected coefficient in the reverse zig-zag order is permitted to become
4 non-zero quantizable.

1 8. The method of claim 5 wherein values of individual elements of a
2 mask classify pixels in corresponding positions within the selected block as
3 relevant or irrelevant.

1 9. The method of claim 5 further comprising the step of:

2 d) providing the modified coefficient block to a block
3 compression process.

1 10. The method of claim 5 wherein step c) further comprises the step of
2 applying a linear program to identify a feasible solution resulting in a zero-
3 quantizable coefficient subject to the constraints.

1 11. The method of claim 10 further comprising the step of applying a
2 quadratic program to generate a modified selected block having minimal
3 energy.

1 12. The method of claim 10 further comprising the step of terminating
2 further modifications to the coefficient block if a ratio of the energy of the
3 modified block to the energy of the initial selected block exceeds a pre-
4 determined threshold.

1 13. The method of claim 5 wherein the forward transform is one of a
2 discrete cosine, a discrete sine, and a discrete Fourier transform.

1 14. A method of decomposing an image comprising the steps of:
2 a) decomposing the image into a plurality of stripes;
3 b) decomposing each stripe into foreground and background
4 image layers, and a mask layer;
5 c) identifying an area of intersection of a common reduced
6 foreground area and a common reduced background areas; and
7 d) interpolating any irrelevant pixel values within the area of
8 intersection for coder efficiency for each layer.

1 15. The method of claim 14, wherein the area of intersection is selected
2 to have an edge that is $8N$ pixels from at least one of an edge of the
3 common reduced foreground area and the common reduced background
4 area, wherein N is an integer, wherein $N \geq 0$.

1 16. The method of claim 14, wherein step d) further comprises the steps
2 of:
3 i) selecting a block of pixels; and
4 ii) classifying each pixel within the selected block as irrelevant or
5 relevant.

1 17. The method of claim 16 further comprising the steps of:
2 iii) calculating an average value of any relevant pixels within the
3 selected block; and
4 iv) assigning the average value to all irrelevant pixels within the
5 selected block.

1 18. The method of claim 14 wherein step c) further comprises the steps
2 of:
3 i) computing a maximum block range for a selected block of the
4 area of intersection;
5 ii) dividing pixels within the selected block into a plurality of
6 groups; and
7 iii) assign each selected group to one of the foreground and
8 background planes in accordance with a relative average luminance value
9 of the selected group and another group, if the maximum block range
10 exceeds a pre-determined threshold.

1 19. The method of claim 18 wherein step c)(iii) further comprises the
2 step of assigning the selected group to the background layer and the other
3 group to the foreground layer if an average luminance of the selected
4 group is greater than an average luminance of the other group, wherein
5 the selected group is assigned to the foreground layer and the other group
6 to the background layer if the average luminance of the selected group is
7 not greater than the average luminance of the other group.

1 20. The method of claim 14 wherein step c) further comprises the steps
2 of:
3 i) computing a maximum block range for a selected block of the
4 area of intersection; and

5 ii) assigning every pixel within the selected block to one of the
6 foreground and the background layers in accordance with whether the
7 average luminance of the selected block is closer to a previous average
8 foreground or previous average background luminance, respectively, if
9 the maximum block range is not greater than a pre-determined threshold.

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